CLAIM

1.   An encoding method for performing variable

length encoding by using correspondence data on non-0

5   coefficient quantity data indicating a quantity of non-0

transformation coefficients in a plurality of

transformation coefficients obtained by performing

orthogonal transformation on image block data,

comprising:

10   when, for respective possible values of said non-0

coefficient quantity data in the image block data having

a first block size, using a plurality of correspondence

data each regulating correspondence of the non-0

coefficient quantity data to the encoding code, so that

15   bit lengths of non-0 coefficient quantity data indicating

"0" become different from one another, and the maximum

bit length of said encoding codes to be used by the

correspondence data becomes longer as the bit lengths of

the non-0 coefficient quantity data indicating "0"

20   becomes shorter,

a first step for assigning a plurality of

transformation coefficients obtained by performing

orthogonal transformation on image block data having a

second block size, which is a multiple of said first

25   block size, to one sub block data in accordance with a

frequency corresponding to the transformation

coefficients among a plurality of sub block data composed

of said transformation coefficients by the same number as

that in image block data having said first block size;

5   a second step for generating said non-0 coefficient

quantity data for each of said plurality of sub block

data based on said transformation coefficients assigned

to the sub block data in said first step; and

a third step for determining said encoding codes to

10   be assigned to said non-0 coefficient quantity data

generated in said second step for each of said plurality

of sub block data by using said correspondence data in

which an encoding code having a shorter bit length is

assigned to said non-0 coefficient quantity data

15   indicating "0" comparing with said correspondence data

used for other sub block data on the direct current

component side with respect to the sub block data.

2.   An encoding method as set forth in claim 1,

wherein said first step uses said plurality of sub block

20   data regulated to be in accordance with frequencies in a

plurality of sub blocks obtained by dividing a vertically

and horizontally two-dimensional frequency region.

3.   An encoding method as set froth in claim 1,

further comprising:

25   a fourth step for generating said non-0 coefficient

quantity data of the image block data based on a

plurality of transformation coefficients obtained by

performing orthogonal transformation on said image block

data having said first block size;

5   a fifth step for specifying a quantity of

transformation coefficients other than "0" and "1" as an

absolute value in said transformation coefficients of

other image block data related to display positions

around a display position related to said image block

10   data having said first block size, and selecting said

correspondence data, wherein said non-0 coefficient

quantity data and an encoding code having a shorter bit

length are related, as the specified quantity becomes

smaller; and

15   a sixth step for determining said encoding code of

said non-0 coefficient quantity data of said image block

data having said first block size by using the

correspondence data selected in said fifth step.

          4.   An encoding method as set forth in claim 3,

20   wherein:

          said first, second and third steps are executed

when said orthogonal transformation is performed in units

of image block data having said second block size; and

          said fourth, fifth and sixth steps are executed

25   when said orthogonal transformation is performed in units

of image block data having said first block size.

     5.   An encoding method as set forth in claim 1, wherein:

     when said first block size is N×N (N is an integer)

5   and said second block size is 2N×2N,

     said first step scans the transformation coefficients of said image data having said second block size successively from a transformation coefficient corresponding to a frequency close to direct current

10 components, and generates first sub block data composed of transformation components scanned first to N^2-th, second sub block data composed of transformation components scanned (N^2+1)-th to $2N^2$-th, third sub block data composed of transformation components scanned

15 $(2N^2+1)$-th to $3N^2$-th, and fourth sub block data composed of transformation components scanned $(3N^2+1)$-th to $4N^2$-th; and

     said third step determines said encoding code of said non-0 coefficient quantity data of said first sub

20 block data by using said correspondence data, wherein a bit length of said encoding code to be assigned to said non-0 coefficient quantity data indicating "0" is longer comparing with that in said correspondence data used for encoding said non-0 coefficient quantity data of said

25 second and third sub block data generated in said second

step, and determines said encoding code of said non-0

coefficient quantity data of said fourth sub block data

by using said correspondence data, wherein a bit length

of said encoding code to be assigned to said non-0

5   coefficient quantity data indicating "0" is shorter

comparing with that in said correspondence data used for

encoding said non-0 coefficient quantity data of said

second and third sub block data generated in said second

step.

10   6.   An encoding method as set forth in claim 1,

wherein:

        said correspondence data

                regulates said encoding code to be assigned

to a set of final continuing quantity data of

15 transformation coefficients of "1" as an absolute value

continuing at the end of a series of said transformation

coefficients obtained by performing orthogonal

transformation on said block data and said non-0

coefficient quantity data; and

20   regulates a bit length of said encoding code

to be the same or longer as said final continuing

quantity data becomes larger for a plurality of sets,

wherein said final continuing quantity data is different

but said non-0 coefficient quantity data is the same.

25   7.   An encoding apparatus for performing variable

length encoding by using correspondence data on non-0

coefficient quantity data indicating a quantity of non-0

transformation coefficients in a plurality of

transformation coefficients obtained by performing

5   orthogonal transformation on image block data,

comprising:

        when, for respective possible values of said non-0

coefficient quantity data in the image block data having

a first block size, using a plurality of correspondence

10   data each regulating correspondence of the non-0

coefficient quantity data to the encoding code, so that

bit lengths of non-0 coefficient quantity data indicating

"0" become different from one another, and the maximum

bit length of said encoding codes to be used by the

15   correspondence data becomes longer as the bit lengths of

the non-0 coefficient quantity data indicating "0"

becomes shorter,

        an assigning means for assigning a plurality of

transformation coefficients obtained by performing

20   orthogonal transformation on image block data having a

second block size, which is a multiple of said first

block size, to one sub block data in accordance with a

frequency corresponding to the transformation

coefficients among a plurality of sub block data composed

25   of said transformation coefficients by the same number as

that in image block data having said first block size;

a generating means for generating said non-0

coefficient quantity data for each of said plurality of

sub block data based on said transformation coefficients

5   assigned to the sub block data by said assigning means;

and

an encoding means for determining said encoding

codes to be assigned to said non-0 coefficient quantity

data generated by said generation means for each of said

10   plurality of sub block data by using said correspondence

data in which an encoding code having a shorter bit

length is assigned to said non-0 coefficient quantity

data indicating "0" comparing with said correspondence

data used for other sub block data on the direct current

15   component side with respect to the sub block data.

8.   An encoding apparatus as set forth in claim 7,

further including:

a differential generating means for generating

differential image data of image data to be encoded and

20   the prediction image data; and

an orthogonally transforming means for performing

said orthogonal transformation on said differential image

data generated by said differential generating means in

units of image block data having said first block size or

25   said second block size,

wherein said assigning means performs said

assigning on said plurality of transformation

coefficients obtained by performing orthogonal

transformation on the image block data having said second

5   block size by said orthogonally transforming means.

9.   A program to be executed by a computer to

perform encoding processing of variable length encoding

by using correspondence data on non-0 coefficient

quantity data indicating a quantity of non-0

10   transformation coefficients in a plurality of

transformation coefficients obtained by performing

orthogonal transformation on image block data, by which:

when, for respective possible values of said non-0

coefficient quantity data in the image block data having

15   a first block size, using a plurality of correspondence

data each regulating correspondence of the non-0

coefficient quantity data to the encoding code, so that

bit lengths of non-0 coefficient quantity data indicating

"0" become different from one another, and the maximum

20   bit length of said encoding codes to be used by the

correspondence data becomes longer as the bit lengths of

the non-0 coefficient quantity data indicating "0"

becomes shorter,

a first procedure for assigning a plurality of

25   transformation coefficients obtained by performing

orthogonal transformation on image block data having a

second block size, which is a multiple of said first

block size, to one sub block data in accordance with a

frequency corresponding to the transformation

5   coefficients among a plurality of sub block data composed

of said transformation coefficients by the same number as

that in image block data having said first block size;

a second procedure for generating said non-0

coefficient quantity data for each of said plurality of

10   sub block data based on said transformation coefficients

assigned to the sub block data in said first procedure;

and

a third procedure for determining said encoding

codes to be assigned to said non-0 coefficient quantity

15   data generated in said second procedure for each of said

plurality of sub block data by using said correspondence

data in which an encoding code having a shorter bit

length is assigned to said non-0 coefficient quantity

data indicating "0" comparing with said correspondence

20   data used for other sub block data on the direct current

component side with respect to the sub block data

are executed by said computer.

10.   A decoding method, for assigning

transformation coefficients obtained by performing

25   orthogonal transformation on image data to be encoded in

units of block data having a second block size, which is

a multiple of a first block size, to a plurality of sub

block data in accordance with frequencies related to the

transformation coefficients; generating non-0 coefficient

5   quantity data indicating a quantity of non-0

transformation coefficients in transformation

coefficients composing the sub block data for each of

said plurality of sub block data; and, when an encoding

code of said non-0 coefficient quantity data is obtained

10   by using predetermined correspondence data, retrieving

said non-0 coefficient quantity data from said encoding

code by using said correspondence data, including:

when, for respective possible values of said non-0

coefficient quantity data in the image block data having

15   a first block size, using a plurality of correspondence

data each regulating correspondence of the non-0

coefficient quantity data to the encoding code, so that

bit lengths of non-0 coefficient quantity data indicating

"0" become different from one another, and the maximum

20   bit length of said encoding codes to be used by the

correspondence data becomes longer as the bit lengths of

the non-0 coefficient quantity data indicating "0"

becomes shorter,

a first step for determining said non-0 coefficient

25   quantity data of each of said encoding codes of said

plurality of sub block data by using said correspondence

data, wherein an encoding code having a longer bit length

comparing with that in said correspondence data used for

said sub block data on the direct current component side

5   and said non-0 coefficient quantity data indicating "0"

are related for the sub block data;

a second step for generating said transformation

coefficients composing the sub block data based on said

non-0 coefficient quantity data determined in said first

10   step for each of said plurality of sub block data; and

a third step for relocating said transformation

coefficients generated in said second step and obtaining

transformation coefficients of said block data having

said second block size.

15   11.   A decoding method as set forth in claim 10,

including:

when decoding said encoding codes of said non-0

coefficient quantity data of transformation coefficients

obtained by performing orthogonal transformation on image

20   data to be encoded in units of block data having a first

block size,

a fourth step for specifying a quantity of

transformation coefficients other than "0" and "1" as an

absolute value in said transformation coefficients of

25   other image block data related to display positions

around a display position related to said image block

data having said first block size;

a fifth step for selecting said correspondence data,

wherein said non-0 coefficient quantity data and an

5   encoding code having a shorter bit length are related, as

the quantity specified in said fourth step becomes

smaller;

a sixth step for determining said non-0 coefficient

quantity data corresponding to said encoding code of said

10   image block data having said first block size by using

the correspondence data selected in said fifth step; and

a seventh step for generating said transformation

coefficients of said block data having said first block

size based on said non-0 coefficient quantity data

15   determined in said sixth step.

12.   A decoding method as set forth in claim 11,

wherein:

said fourth, fifth, sixth and seventh steps are

executed when said first block size is instructed; and

20   said first, second and third steps are executed

when said second block size is instructed.

13.   A decoding apparatus, for assigning

transformation coefficients obtained by performing

orthogonal transformation on image data to be encoded in

25   units of block data having a second block size, which is

a multiple of a first block size, to a plurality of sub

block data in accordance with frequencies corresponding

to the transformation coefficients; generating non-0

coefficient quantity data indicating a quantity of non-0

5   transformation coefficients in transformation

coefficients composing the sub block data for each of

said plurality of sub block data; and, when an encoding

code of said non-0 coefficient quantity data is obtained

by using predetermined correspondence data, retrieving

10   said non-0 coefficient quantity data from said encoding

code by using said correspondence data, including:

when, for respective possible values of said non-0

coefficient quantity data in the image block data having

a first block size, using a plurality of correspondence

15   data each regulating correspondence of the non-0

coefficient quantity data to the encoding code, so that

bit lengths of non-0 coefficient quantity data indicating

"0" become different from one another, and the maximum

bit length of said encoding codes to be used by the

20   correspondence data becomes longer as the bit lengths of

the non-0 coefficient quantity data indicating "0"

becomes shorter,

a determining means for determining said non-0

coefficient quantity data of each of said encoding codes

25   of said plurality of sub block data by using said

correspondence data, wherein an encoding code having a

longer bit length comparing with that in said

correspondence data used for said sub block data on the

direct current component side and said non-0 coefficient

5   quantity data indicating "0" are related for the sub

block data as the bit lengths of non-0 coefficients

quantity data indicating "0" becomes shorter;

a generating means for generating said

transformation coefficients composing the sub block data

10   based on said non-0 coefficient quantity data determined

in said determining means for each of said plurality of

sub block data; and

a retrieving means for relocating said

transformation coefficients generated by said generating

15   means and obtaining transformation coefficients of said

block data having said second block size.

14.   A program to be executed by a computer, for

assigning transformation coefficients obtained by

performing orthogonal transformation on image data to be

20   encoded in units of block data having a second block size,

which is a multiple of a first block size, to a plurality

of sub block data in accordance with frequencies related

to the transformation coefficients; generating non-0

coefficient quantity data indicating a quantity of non-0

25   transformation coefficients in transformation

coefficients composing the sub block data for each of

said plurality of sub block data; and, when an encoding

code of said non-0 coefficient quantity data is obtained

by using predetermined correspondence data, retrieving

5   said non-0 coefficient quantity data from said encoding

code by using said correspondence data, by which:

when, for respective possible values of said non-0

coefficient quantity data in the image block data having

a first block size, using a plurality of correspondence

10   data each regulating correspondence of the non-0

coefficient quantity data to the encoding code, so that

bit lengths of non-0 coefficient quantity data indicating

"0" become different from one another, and the maximum

bit length of said encoding codes to be used by the

15   correspondence data becomes longer as the bit lengths of

the non-0 coefficient quantity data indicating "0"

becomes shorter,

a first procedure for determining said non-0

coefficient quantity data of each of said encoding codes

20   of said plurality of sub block data by using said

correspondence data, wherein an encoding code having a

longer bit length comparing with that in said

correspondence data used for said sub block data on the

direct current component side and said non-0 coefficient

25   quantity data indicating "0" are related for the sub

block data;

a second procedure for generating said

transformation coefficients composing the sub block data

based on said non-0 coefficient quantity data determined

5   in said first procedure for each of said plurality of sub

block data; and

a third procedure for relocating said

transformation coefficients generated in said second

procedure and obtaining transformation coefficients of

10   said block data having said second block size

are executed by said computer.

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